

AP Calculus AB
Ch.4 Review

Name _____

1. Locate the absolute extrema of $f(x) = x^2 - 2x - 4$ on $[-1, 3]$

2. Locate the absolute extrema of $f(x) = 4x - x^2$ on $[0, 5]$

3. Given $f(x) = x^2 + 8x + 10$, find the critical numbers of f , the open intervals on which f is increasing or decreasing, and locate all relative extrema.

4. List any extrema and/or points of inflection, and describe the concavity of $f(x) = 5 + 3x^2 - x^3$

5. Find the limits:

a) $\lim_{x \rightarrow \infty} \frac{2x - 6}{x^2 - 3x}$

b) $\lim_{x \rightarrow \infty} \frac{(x^2 + 1)(x^2 - 1)}{2x^4}$

c) $\lim_{x \rightarrow -\infty} \frac{-x}{\sqrt{x^2 - 2}}$

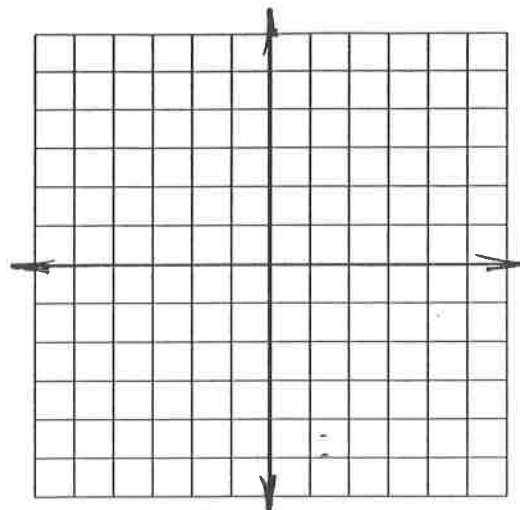
6. Let $f(x) = (x-2)^5 - 15$. What type of point is $(2, -15)$?

7. Find a relative minimum for $f(x) = 2x^3 - 3x^2 - 12x + 8$. Verify that it is a minimum.

8. How close does the curve $y = \sqrt{x}$ come to the point $\left(\frac{3}{2}, 0\right)$?

9. Find all asymptotes of $f(x) = \frac{x-1}{x^2-9} + \frac{5-2x}{3x}$.

10. Sketch the graphs of the first and second derivatives of $y = \frac{1}{3}x^3 + 2x$



Multiple-Choice Questions

A graphing calculator is required for some questions. When graphing trig functions, change to radian mode.

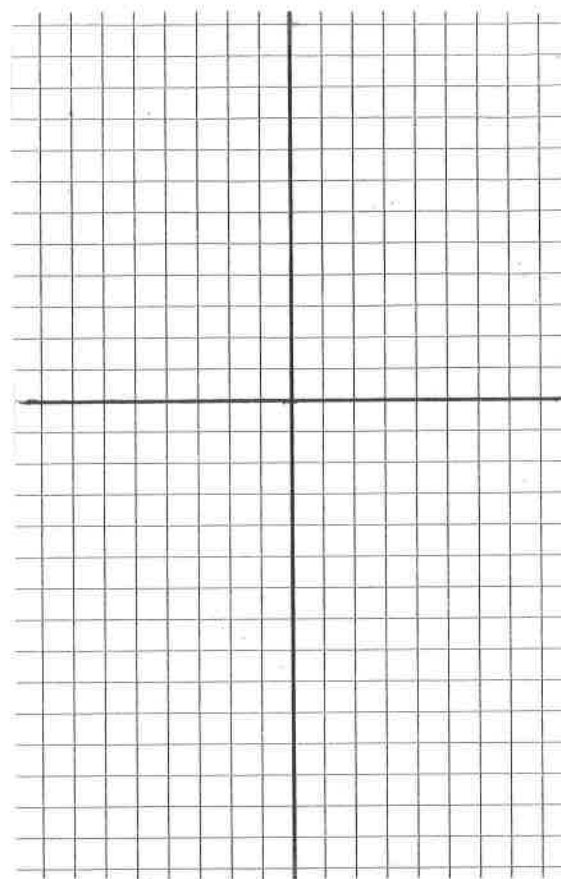
1. Which of the following functions satisfy the hypotheses of Rolle's Theorem on the interval $[0, 2]$?
I $f(x) = \frac{1}{|x-1|}$
II $f(x) = |x-1|$
III $f(x) = x^2 - 2x$
(A) I only
(B) II only
(C) III only
(D) II and III
(E) I, II, and III
2. Which of the following functions satisfy the hypotheses of the Mean Value Theorem on the interval $[0, 2]$?
I $f(x) = \sin \pi x + \cos 2x$
II $f(x) = \sqrt[3]{x-8}$
III $f(x) = |x^2 - 2x|$
(A) I only
(B) II only
(C) III only
(D) I and II
(E) I, II, and III
3. How many values of c satisfy the conclusion of the Mean Value Theorem for $f(x) = x^3 + 1$ on the interval $[-1, 1]$?
(A) 0
(B) 1
(C) 2
(D) 3
(E) 4
4. How many values of c are guaranteed by Rolle's Theorem for the function $f(x) = \frac{\sin x}{x}$ on the interval $[-10, 10]$?
(A) 4
(B) 5
(C) 6
(D) 7
(E) The theorem does not apply.

Free-Response Questions

A graphing calculator is required for some questions.

5. Find the value(s) of c guaranteed by Rolle's Theorem for $f(x) = x \sin x$ on the interval $[-3, 3]$.
6. (a) Find the value of c guaranteed by the Mean Value Theorem for $f(x) = e^x - x$ on the interval $[-2, 2]$.
(b) Using the DRAW menu on the calculator (**[2nd]** DRAW 5: Tangent), draw a line tangent to the graph of $f(x) = e^x - x$ at the value of c found in part (a). Then go to **[2nd]** DRAW 2: Line, and draw a line joining $(-2, f(-2))$ and $(2, f(2))$.
(c) Write a sentence describing the tangent line and the line joining the endpoints of the curve.

7. Sketch the graph of $f(x) = x^4 - 4x^3 + 2$. Use the first and second derivatives to find any maxima, minima, and points of inflection. Indicate these points clearly on the graph.



8. A rectangular vegetable garden is to be enclosed using the wall of a building as one side and 60 feet of fencing on the other three sides. Find the dimensions of the rectangle that will give the maximum area for the garden.